ATV71 POSITIONING

User manual

Schneider Electric

Document rev. 8
Manual comply to: ATV71 Positioning application V4.1.4

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1 INTRODUCTION

ATV71 Positioning card is an option card with software that makes it possible to have positioning functions with the drive ATV71. Example likes to manage absolute and relative positioning movements. Functions as different homing modes and jogging functions are also possible.

2 OVERVIEW

2.1 TERMINAL CONNECTIONS

Some inputs and outputs on the ATV71 have fixed functions. This is managed by the positioning software. See chapter ”INPUTS / OUTPUTS” for more information.

2.2 REFERENCE CHANNEL

It’s possible to have 3 different reference channels.
Terminal: Physical drive I/O with preset positions, speeds ,etc.
Com.card: Communication card supported by ATV71 or the integrated Modbus.
CANopen: Integrated CANopen port.

2.3 STARTUP

After a clean startup it’s necessary to make a homing. The software supports different kind of homing modes. See chapter ”HOMING MODE” for more information.

2.4 MOTOR CONTROL LAW

2.4.1 Encoder on motor shaft

The motor control law should be selected to **[FVC]** Full Flux vector closed loop.
Encoder mounted direct on the motor shaft is the recommended solution.
This gives the most benefits like:
Full torque from 0Hz.
Better and faster brake logic control.
Better torque and speed accuracy.
See chapter 1.5 [Motor control] in ATV71 programming manual for more information regarding FVC mode.
For vertical load this motor law is mandatory.

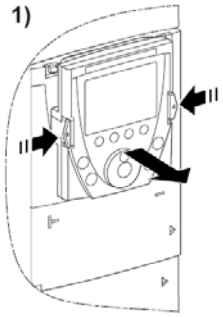
2.4.2 Extern Encoder Function

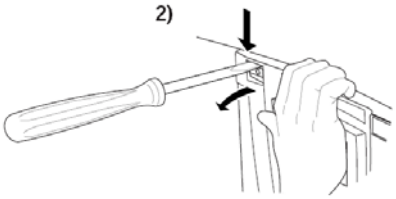
Use this function if the encoder is not mounted on the motor shaft.
Motor control law should be selected to **[SVC U]** or more preferred **[SVC I]** Flux vector open loop.
This means that we don’t get any advantages from the encoder to have a better torque or speed accuracy that we get if the encoder would be mounted on the motor shaft.
Work good with horizontal movements with less performance requirements.
The encoder must be connected to a standard encoder board.

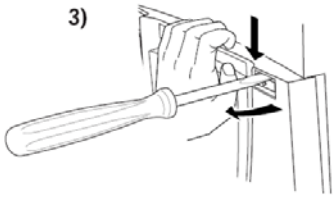
3 INSTALLATION

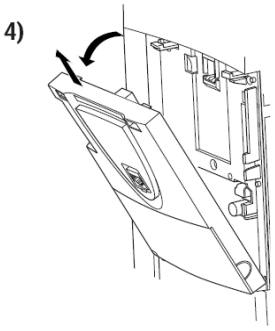
3.1 INSTALLATION OF OPTION CARDS

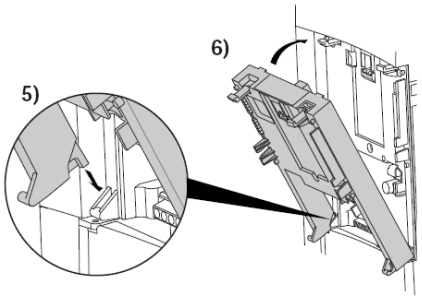
For ATV71 Positioning card and communication cards.

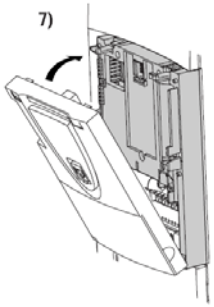


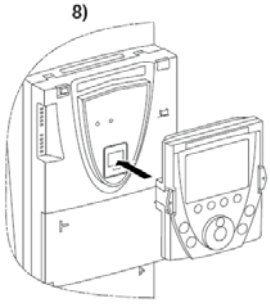






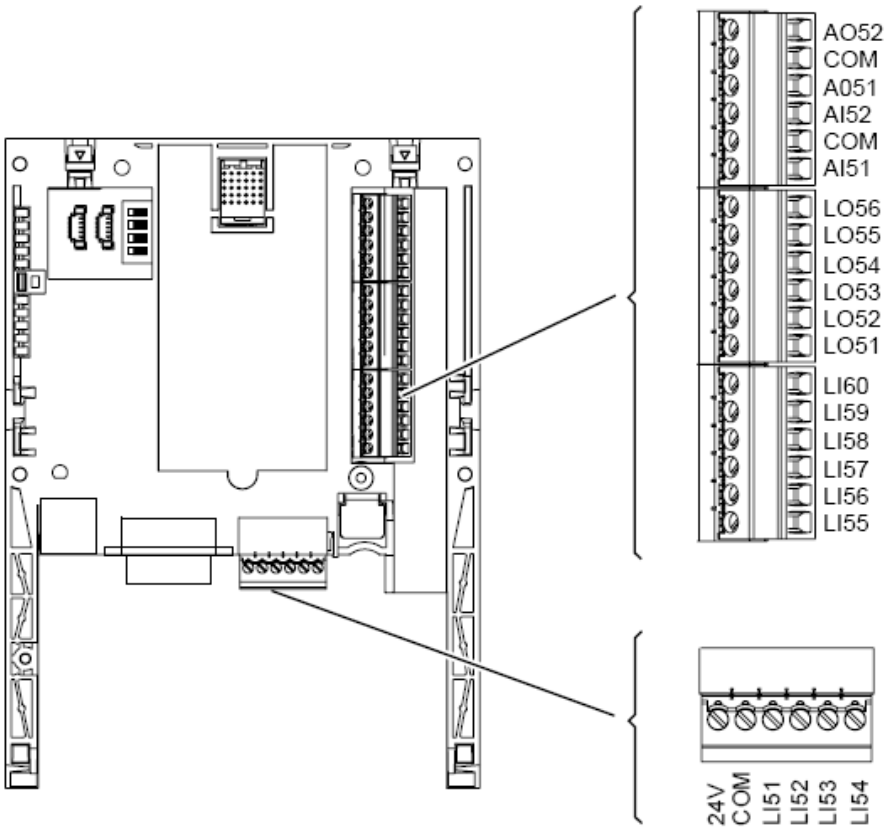






3.2 24VDC

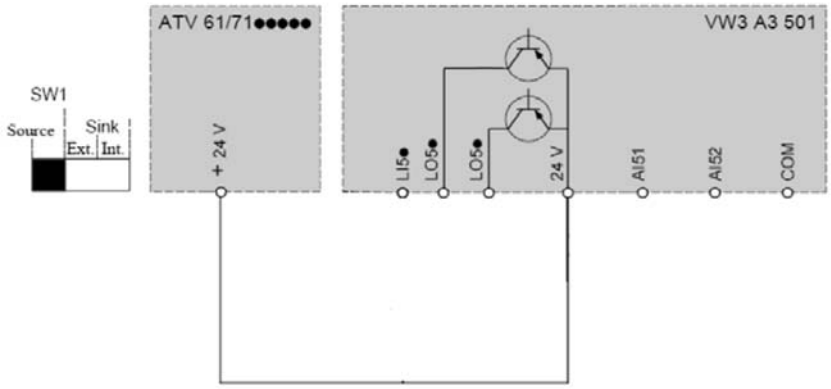
ATV71 Positioning card needs 24VDC to terminal marked 24V to function.



Terminal	Description
24V	Power supply for the "Controller Inside" card, logic outputs and analog outputs. If allowed by the power consumption table (for example if outputs are not being used), the "Controller Inside" card can be powered by the 24 V power supply in the drive. If you are using an external power supply: •The "Controller Inside" card should preferably be turned on before the drive. However, the "Controller Inside" card must without fail be turned on no more than 2s after the drive is turned on. Failure to follow this instruction locks the drive in card fault mode (ILF). This fault cannot be reset, and the only way to acknowledge it is to turn off the drive.
COM	Common ground and electrical 0V of the "Controller Inside" card power supply, logic inputs, (LIxx), outputs (LOxx), analog inputs (AIxx) and analog outputs (AOxx). This ground and electrical 0V are common with the drive ground and electrical 0V. There is therefore no point in connecting this terminal to the 0V terminal on the drive control terminals.
LI, LO, AI and AO	See chapter ”INPUTS/OUTPUTS” for those functions.

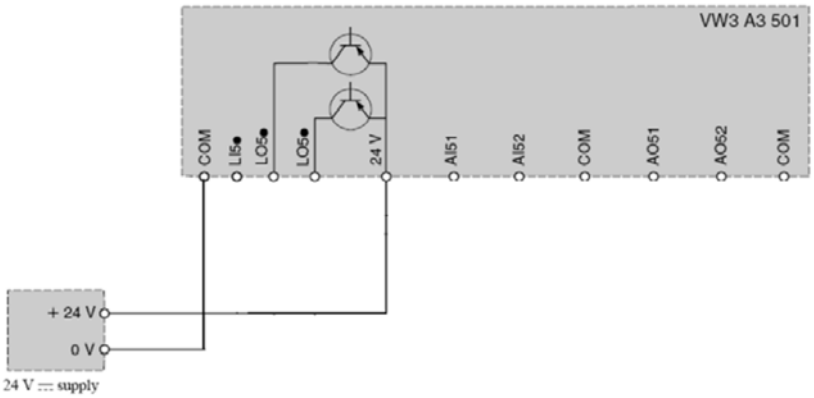
3.2.1 Card powered by the drive

If the power consumption is less than 200mA.
Example: Use of communication card as reference source and no outputs is used.



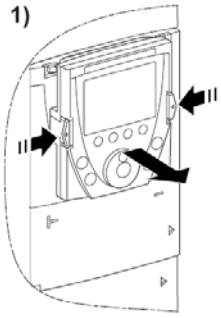
3.2.2 Card powered by external power supply

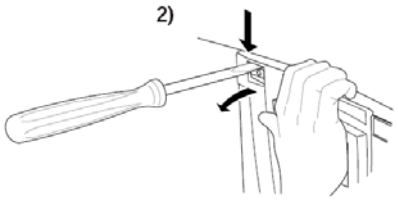
If the power consumption is higher than 200mA.
Example: Use of Terminal as reference source.

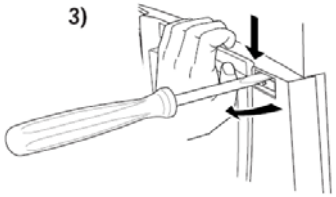


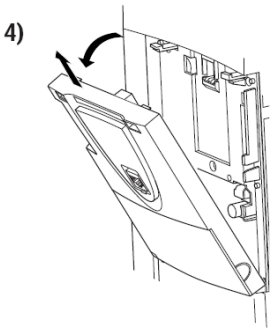
3.3 INSTALLATION OF ENCODER BOARDS

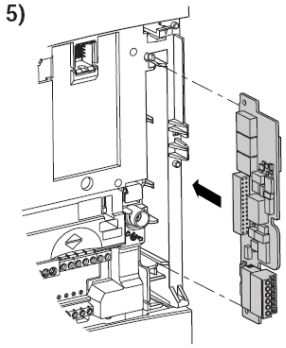
For all encoder board references.

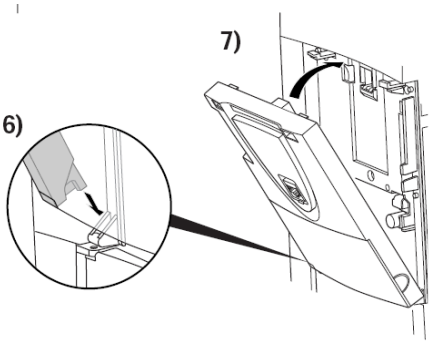


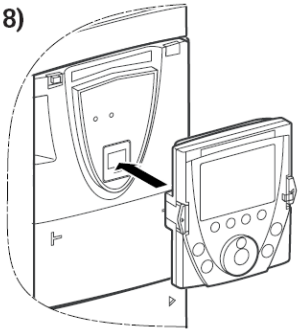


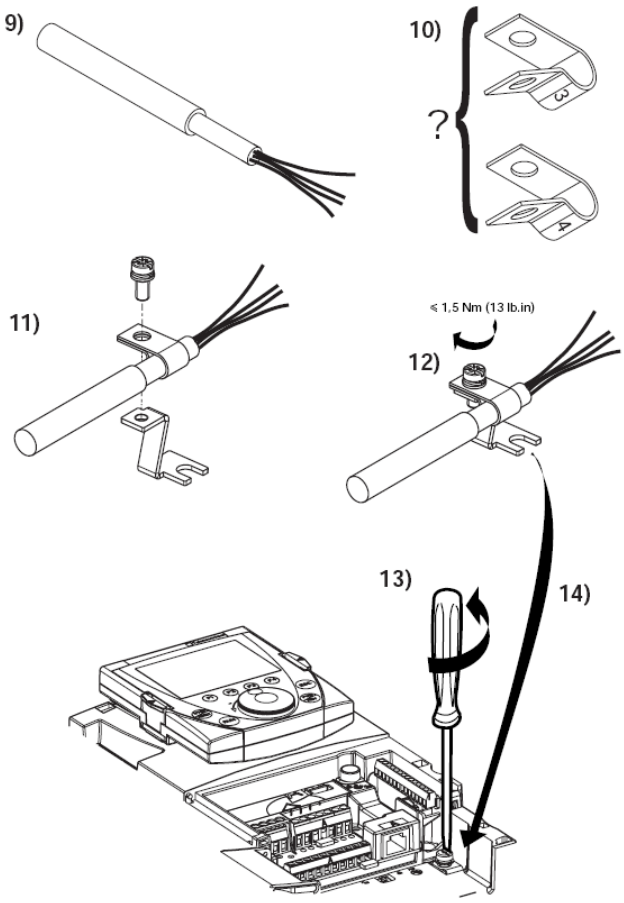


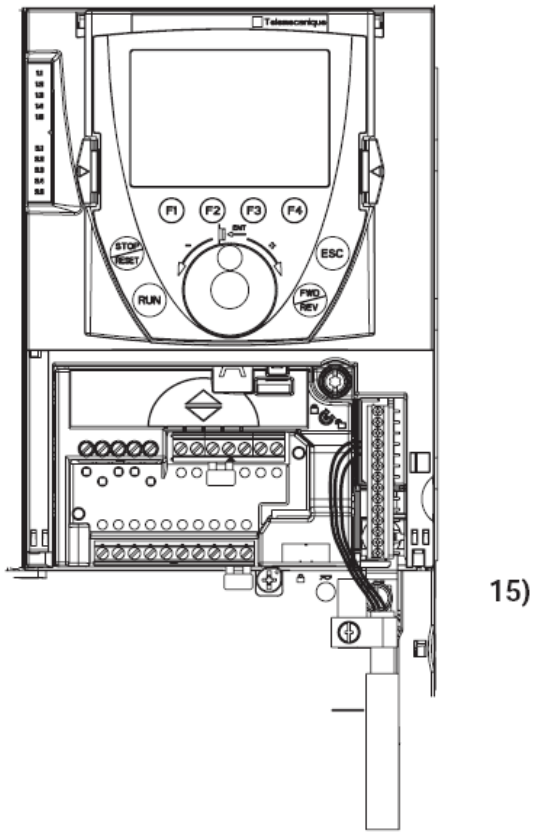


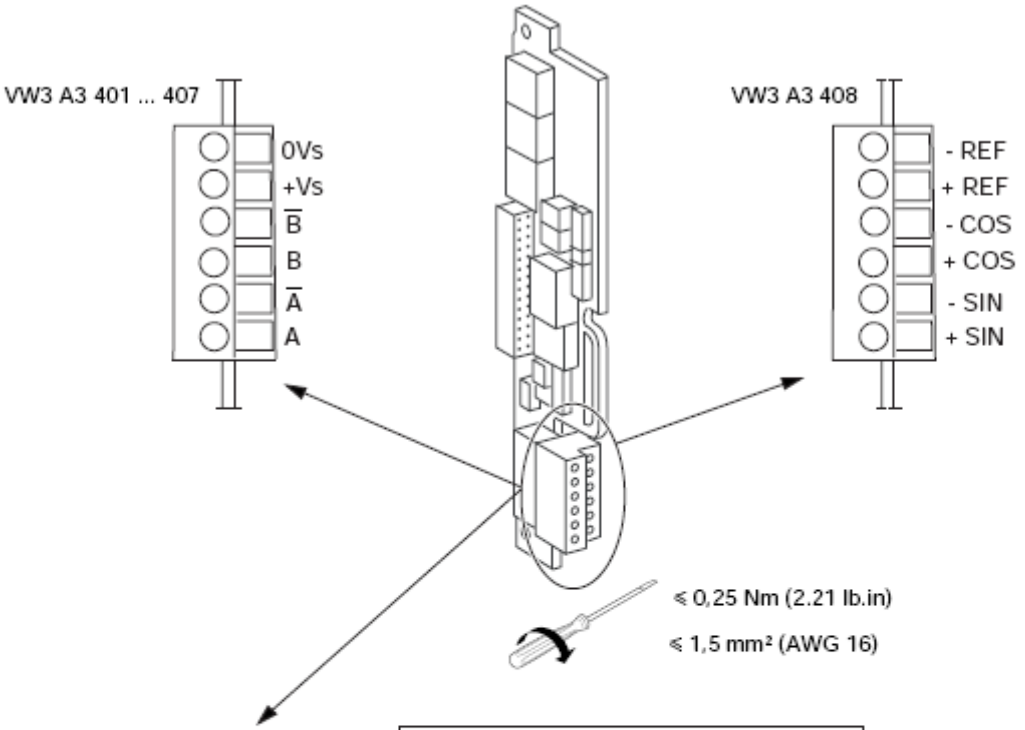







9)
10)
?
11)
≤ 1,5 Nm (13 lb.in)
12)
13)
14)


F1
F2
F3
F4
ESC
STOP RESET
RUN
FWD REV
15)



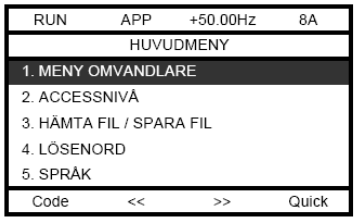
VW3 A3 409

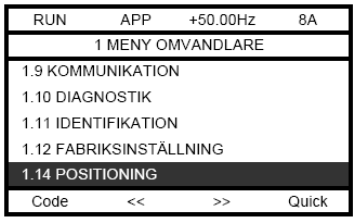
	Endat	SSI	Hiperface	SinCos
0 (0V)	X	X	X	X
V+ (V+)	X	X	X	X
CL- (Clock -)	X	X		
CL+ (Clock +)	X	X		
D- (Data -)	X	X	X	
D+ (Data +)	X	X	X	
S- (Sin -)			X	X
S+ (Sin +)			X	X
C- (Cos -)			X	X
C+ (Cos +)			X	X

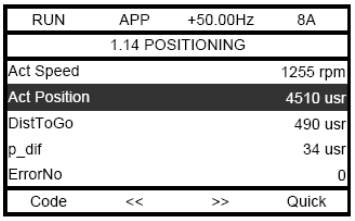
4 POSITIONING MENU

4.1 MENU OVERVIEW

To be able to manage the new parameters for the positioning software there is a new menu **[1.14 POSITIONING].**
From this menu you make every adjustment for your machine axis.







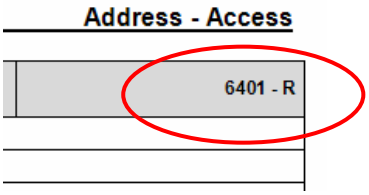
See chapter"PARAMETERS" for a full list of all available parameters for the positioning application.

5 PARAMETERS

5.1 PARAMETER ACCESS

It's possible from a superior PLC to read and write all parameters.
All "Read only" parameters is also accessible from menu [1.2 MONITORING] and [6 MONITORING CONFIG.]
Address and Access level is described in the parameter table:

R = Read only
R/W = Read, Write
R/WS = Read, Write (writable without enable)



5.2 LIST OF ALL PARAMETERS

Displaycode - Parameter name **Address - Access**

O01 - Act Speed	**6401 - R**
Description	Actual speed
Range	0 ⇔ 32767
Default	
Unit	Rpm
Function	Actual motor/axis speed.

O02 - Act Position	**6402 - R**
Description	Actual position
Range	-32768 ⇔ 32767
Default	
Unit	usr (User unit, see Position scaling for more info)
Function	Actual motor/axis position.

O03 - DistToGo	**6403 - R**
Description	Distance to go
Range	-32768 ⇔ 32767
Default	
Unit	usr (User unit, see Position scaling for more info)
Function	Distance to go before reaching target position.

O04 - p_dif	**6404 - R**
Description	Following Error
Range	-32768 ⇔ 32767
Default	
Unit	usr (User unit, see Position scaling for more info)
Function	Displays the relationship between actual position and profile position.

O05 - ErrorNo.	**6405 - R**
Description	Actual error number
Range	0 ⇔ 15
Default	
Unit	
Function	Find more info in chapter “ALARM NUMBER”

O06 – Active Mode	**6406 - R**
Description	Active mode
Range	0 ⇔ 4
Default	
Unit	
Function	0 = No mode 1 = Positioning mode 2 = Jogging mode 3 = Homing mode 4 = Blending mode (2 Speed positioning)

O08 - Command	**6408 – R/WS**
Description	Command and reference channel
Range	Terminal (0), Com.Card (1), CANopen (2)
Default	Terminal (0)
Unit	
Function	0 – Terminal (Physical In and Outputs.) 1 – Com.Card (Option Com card or the integrated Modbus port.) 2 – CANopen (Integrated CANopen port.)

O09 - HMmethod	**6409 – R/W**
Description	Homing method
Range	1..5
Default	1
Unit	
Function	Find more info in chapter”HOMING MODE”.

O10 - Home_speed	**6410 – R/W**
Description	Speed for homing movement
Range	4 ⇔ 3000
Default	300
Unit	rpm
Function	Speed for homing sequence. Find more info in chapter"HOMING MODE".

O11 - JOG_speed	**6411 – R/W**
Description	Speed for jogging
Range	1 ⇔ 3000
Default	100
Unit	rpm
Function	Speed for jogging sequence.

O12 - AI1 Adjust	**6412 – R/WS**
Description	Activate AI1 for speed override adjustment
Range	No (0) ⇔ Yes (1)
Default	No (0)
Unit	
Function	Activate input AI1 to be a speed override adjustment. 0-100% of Target Speed.

O13 - ScaleNum	**6413 – R/WS**
Description	Numerator scale factor for user unit
Range	0 ⇔ 65535
Default	1
Unit	Motor rotation
Function	Use to scale Usr (User units) to the axis geometry. Find more info in chapter"POSITION SCALING".

O14 - ScaleDenom	**6414 – R/WS**
Description	Denominator scale factor for user unit
Range	0 ⇔ 65535
Default	20
Unit	usr (User unit, see Position scaling for more info)
Function	Use to scale Usr (User units) to the axis geometry. Find more info in chapter"POSITION SCALING".

O15 - ExtEncoder	**6415 – R/WS**
Description	Activate function External Encoder
Range	No (0) ⇔ Yes (1)
Default	No (0)
Unit	
Function	External Encoder function can be used to carry out direct position measurement in the installation. Find more info in chapter"EXTERNAL ENCODER".

O16 - ExtEncNum	**6416 – R/WS**
Description	Numerator scale factor for external encoder function
Range	0 ⇔ 65535
Default	100
Unit	Encoder pulses
Function	Find more info in chapter"EXTERNAL ENCODER".

O17 - ExtEncDenom	**6417 – R/WS**
Description	Denominator scale factor for external encoder function
Range	0 ⇔ 65535
Default	1
Unit	Motor rotations
Function	Find more info in chapter"EXTERNAL ENCODER".

O18 - HW_QuickStop	**6418 – R/WS**
Description	Activate LI60 QuickStop function
Range	No (0) ⇔ Yes (1)
Default	Yes (1)
Unit	
Function	Activate hardware logic input LI60 - QuickStop function

O19 - KPp	**6419 – R/W**
Description	Proportional gain factor for positioning loop
Range	1 ⇔ 100
Default	5
Unit	
Function	**KPp good**: The machine behavior is acceptable **KPp too great**: overshooting of the mechanism, instability of the motor control. **KPp too small**: Slow response and to long time to get Target Reached, very large following error

O21 - PLCRampAdj	**6421 – R/W**
Description	Activate PLC ramp adjusting
Range	No (0) ⇔ Yes (1)
Default	No (0)
Unit	
Function	Activate access for PLC to write parameter Acceleration and Deceleration from COM.SCANNER IN.

O22 - Acceleration	**6422 – R/W**
Description	Acceleration ramp
Range	100 ⇔ 30000
Default	1000
Unit	Rpm/s^2
Function	Acceleration ramp of the profile generator.

O23 - Deceleration	**6423 – R/W**
Description	Deceleration ramp
Range	100 ⇔ 30000
Default	1000
Unit	Rpm/s^2
Function	Deceleration ramp of the profile generator.

O24 - QStopRamp	**6424 – R/W**
Description	Multiplier for QuickStop ramp
Range	100 ⇔ 30000
Default	2000
Unit	Rpm/s^2
Function	Deceleration ramp of the profile generator on a Quick Stop command.

O25 - InPosWin	**6425 – R/W**
Description	In Position Window
Range	0 ⇔ 32767
Default	1
Unit	usr (User unit, see Position scaling for more info)
Function	Target position window for report of Target reached To get Target Reached both InPosWin and InPosTime must be true.

O26 - InPosTime	**6426 – R/W**
Description	In Position Time
Range	1 ⇔ 3000
Default	20
Unit	Ms (milliseconds)
Function	Target position window time for report of Target reached To get Target Reached both InPosWin and InPosTime must be true.

O27 - RefPointPosition	**6427 – R/W**
Description	Position to set on a finished Homing procedure
Range	-32768 ⇔ 32767
Default	0
Unit	usr (User unit, see Position scaling for more info)
Function	This value is copied to Actual Position on a finished Homing procedure. Find more info in chapter"HOMING MODE".

O28 - P_maxDiff	**6428 – R/W**
Description	Max permissible following error
Range	1 ⇔ 65535
Default	100
Unit	usr (User unit, see Position scaling for more info)
Function	If following error is greater that this value the drive stops on Freewheel and report Alarm number 1.

O29 - IOsigLIMx	**6429 – R/W**
Description	Activate hardware limit switches
Range	None (0), N-Open (1), N-Closed (2)
Default	None
Unit	
Function	0, None: no limit switches 1, N-Open: 2 limit switches with normal open contact 2, N-Closed: 2 limit switches with normal closed contact

O30 - IOsigREF	**6430 – R/W**
Description	Activate reference switch
Range	None (0), N-Open (1), N-Closed (2)
Default	N-Open (1)
Unit	
Function	0, None: no reference switch 1, N-Open: reference switch with normal open contact 2, N-Closed: reference switch with normal closed contact

O31 - SW_Limits	**6431 – R/W**
Description	Activate software limits
Range	No (0), Yes (1)
Default	No (0)
Unit	
Function	0, No: no software limits. 1, Yes: software limits in both directions is monitored. Config parameter SW_LimN and SW_LimP to your limit values.
O32 - SW_LimN	**6432 – R/W**
Description	Max position in negative direction
Range	-32768 ⇔ 32767
Default	-32768
Unit	usr (User unit, see Position scaling for more info)
Function	If a target position is sent outside this position the Alarm number 2 gets active.
O33 - SW_LimP	**6433 – R/W**
Description	Max position in positive direction
Range	-32768 ⇔ 32767
Default	32767
Unit	usr (User unit, see Position scaling for more info)
Function	If a target position is sent outside this position the Alarm number 3 gets active.
O34 - HMdistOut	**6434 – R/W**
Description	Extract distance from homing switch
Range	0.0 ⇔ 50.0
Default	0.0
Unit	Motor rotation
Function	Find more info in chapter ”HOMING MODE”.
O35 - AdvScaling	**6435 – R/WS**
Description	Activate advanced scaling
Range	No (0), Yes (1)
Default	No (0)
Unit	
Function	Activate parameters ScaleNumHw and ScaleDenomHw. This parameters complement ScaleNum and ScaleDenom to be able to use bigger values then 65535 in the scaling of [Usr - User unit].

O36 - ScaleNumHw	**6436 – R/WS**
Description	Numerator 2 scale factor for user unit
Range	0 ⇔ 65535
Default	0
Unit	Motor rotations
Function	Use to scale Usr (User units) to the axis geometry. Find more info in chapter"POSITION SCALING".

O37 - ScaleDenomHw	**6437 – R/WS**
Description	Denominator 2 scale factor for user unit
Range	0 ⇔ 65535
Default	0
Unit	usr (User unit, see Position scaling for more info)
Function	Use to scale Usr (User units) to the axis geometry. Find more info in chapter"POSITION SCALING".

O40 - SetMotionTask	**6440 – R/WS**
Description	The Motion task number to adjust
Range	0 ⇔ 15
Default	0
Unit	
Function	Motion Task number to adjust the following parameters: Position, Speed, Acceleration, Deceleration

O41 - Position	**6441 – R/WS**
Description	Position for motion task 1..15
Range	-32768 ⇔ 32767
Default	0
Unit	usr (User unit, see Position scaling for more info)
Function	Position for motion task number (SetMotionTask).

O42 - Speed	**6442 – R/WS**
Description	Speed for motion task 1..15
Range	0 ⇔ 6000
Default	0
Unit	rpm
Function	Speed for motion task number (SetMotionTask).

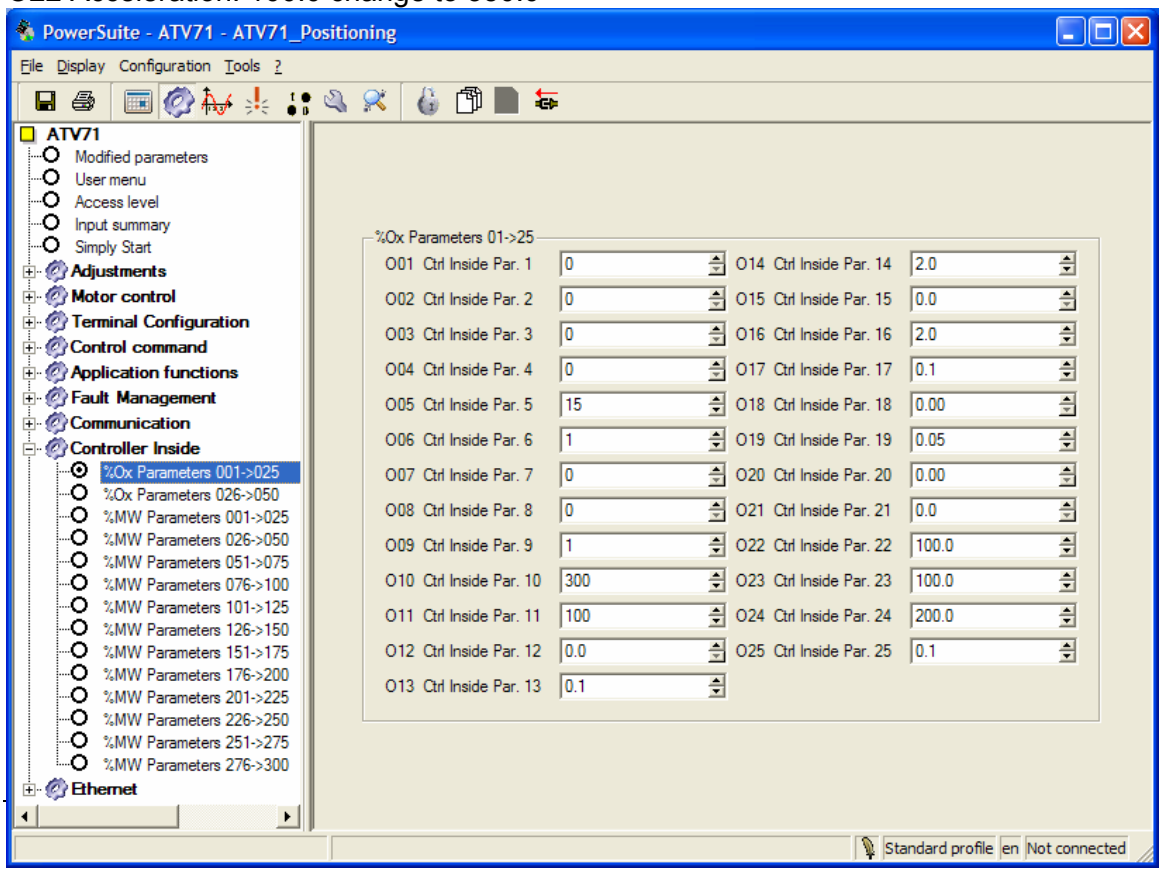
O43 - Acceleration	6443 – R/WS
Description	Acceleration for Motion Task 1..15
Range	100 ⇔ 30000
Default	1000
Unit	Rpm/s²
Function	Acceleration for motion task number (SetMotionTask).

O44 - Deceleration	6444 – R/WS
Description	Deceleration for Motion Task 1..15
Range	100 ⇔ 30000
Default	1000
Unit	Rpm/s²
Function	Deceleration for motion task number (SetMotionTask).

5.3 POWERSUITE

All parameter are compatible with PowerSuite software. But there's a limit with the parameter names and units. As the picture shows, the names is only described as Oxx display numbers. And the units is not correct. However it's possible to change the parameters with PowerSuite. You have to see the parameter value without the decimal point, but when you change the value the decimal point must be present.

Example:
Change Acceleration value from 1000 to 3500rpm/s².
O22 Acceleration: 100.0 change to 350.0



6 POSITION SCALING

Scaling translates user units to internal units of the device, and vice versa. The device saves position values in user-defined units.

The scaling factor creates the relationship between the number of motor rotations and the required user units [usr] needed for this. It is specified in [rev/usr].

Calculation of the scaling factor is done with parameters ScaleNum and ScaleDenom

$$\text{Scaling factor} = \frac{\text{ScaleNum [rev]}}{\text{ScaleDenom [usr]}}$$

Example 1:
The machine moves 100mm on 2 motor rotations.

$$\text{Scaling factor} = \frac{2 \quad \text{motor rotations [rev]}}{100 \quad \text{user units [usr]}}$$

The scale factor is now correct for a resolution of 1mm. To move 1mm we send 1 usr as target position.
To get a better resolution of the Target Position we can multiply ScaleDenom with 10. Now the resolution is set to 0,1mm.

Example 2:
The machine moves 360 degrees on 2.5 motor rotations.
The smallest position increment to be moved should be 0.1 degree.
2,5 rev * 10 = **25 rev** and 360 degree * 100 = **36000 usr**
The value 36000 is a little too big so we can divide the values with a common divider.
(250 / 5) = **5 rev** and (36000 / 5) = **7200 usr**

$$\text{Scaling factor} = \frac{25 \quad \text{motor rotations [rev]}}{36000 \quad \text{user units [usr]}}$$

The scale factor is now correct. To move 0.1 degree we send 1 usr as target position.

Using bigger scaling values then 65535:
If you need bigger values than 65535 for scaling, first try to find the biggest common divider. If this is not enough, you can activate “AdvScaling” parameter.
The 2 new parameters ScaleNumHw and ScaleDenomHw are used as a complement together with standard ScaleNum and ScaleDenom parameters.
The new parameters represent the high word in a double word. And the default parameters represent the low word in a double word.

Please contact Schneider Electric for help calculating this parameters correct.

7 EXTERNAL ENCODER

This external encoder function can be used to carry out direct position measurement in the installation (actual position).
Remember that the external encoder has no influence on the speed and current regulators inside the drive. No vertical load is allowed.

Activate with parameter “ExtEncoder” = Yes
The encoder is connected to one of the standard encoder boards available.
You use the regular scaling parameters ScaleNum and ScaleDenom for User units.
The new parameters for external encoder scaling is to define the pulses from the external encoder to motor rotations.

Calculation of the scaling factor is done with parameters ExtEncNum and ExtEncDenom.

$$\text{Scaling factor} = \frac{\text{ExtEncNum [EncInc]}}{\text{ExtEncDenom [rev]}}$$

Example:
The external encoder has a resolution of 1024 inc/rev.
One turn of the encoder is exactly 3 motor rotations.

$$\text{Scaling factor} = \frac{\text{1024 encoder pulses [EncInc]}}{\text{3 motor rotations [rev]}}$$

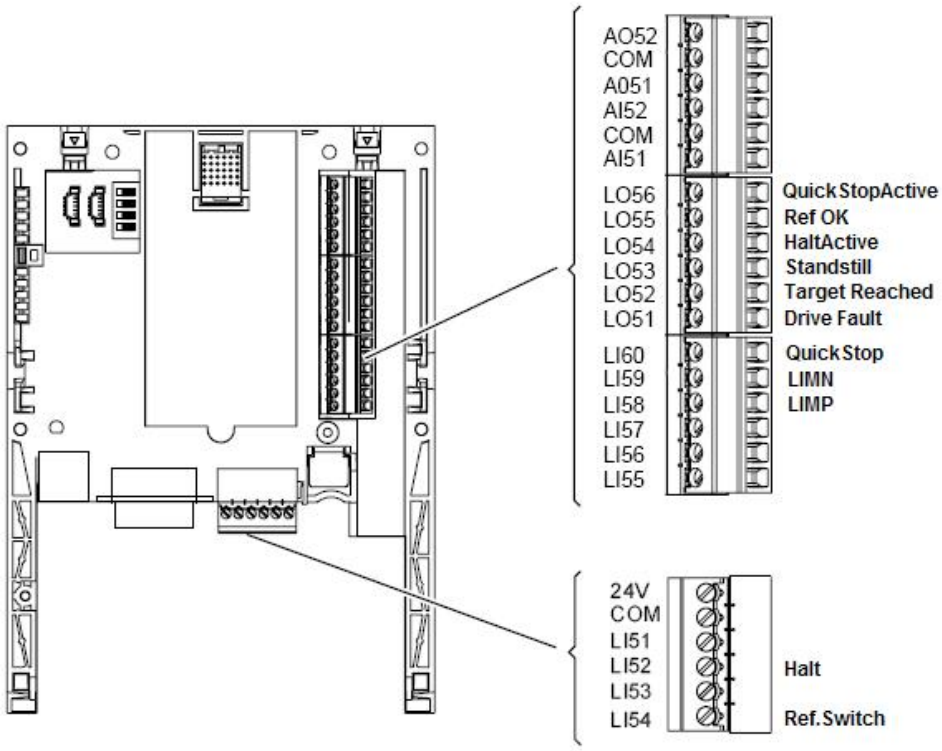
The scale factor is now set correct.

See chapter”POSITION SCALING” for more information to scale your user units correct.

8 INPUTS / OUTPUTS

8.1 I/O CONFIG FOR ALL COMMAND TYPES

This I/O configuration is standard for all reference channels.



Input	Name	Function
LI52	Halt	0->1: Brakes the motor with normal deceleration ramp 1->0: Interrupted movement is continued
LI54	Ref. Switch	Reference switch
LI58	LIMP	Hardware limit switch in positive direction
LI59	LIMN	Hardware limit switch in negative direction
LI60	QuickStop	1->0: Brakes the motor with deceleration ramp defined in parameter ”QStopRamp” Interrupted movement is loosed.
Output	**Name**	**Function**
LO51	Drive Fault	A drive fault is present. Drive is disabled. (Find more info in chapter ”ALARM NUMBER”)
LO52	Target Reached	Movement finished and has reached the InPosWin
LO53	Standstill	Motor at standstill
LO54	HaltActive	A halt command is active.
LO55	Ref OK	A Homing has been done correct after startup.
LO56	QuickStopActive	QuickStop is activated. Clear with Fault Reset. Interrupted movement is loosed.

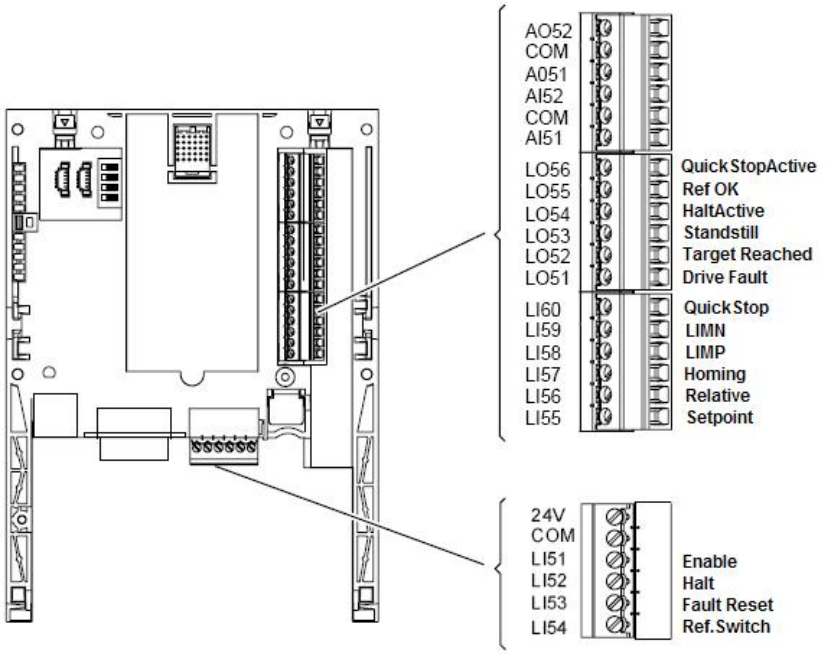
9 COMMAND TYPES

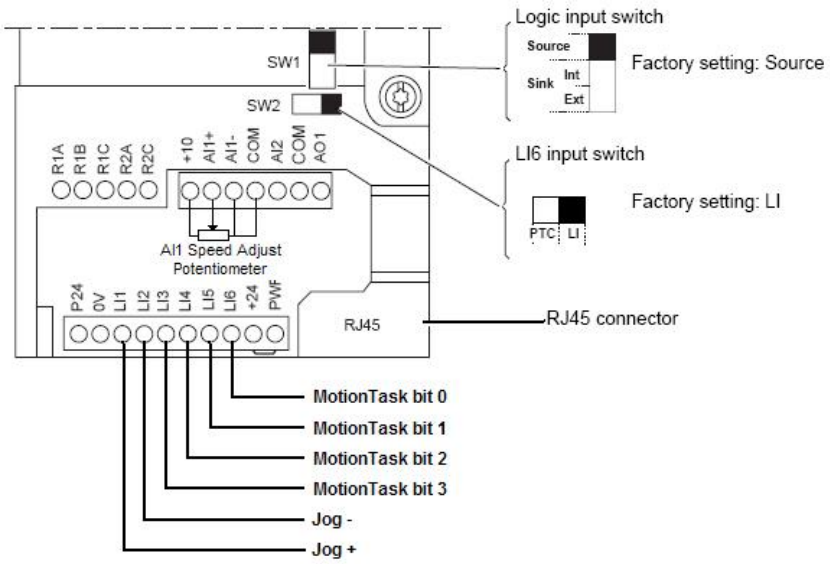
To activate positioning software it's mandatory to change following parameter in menu 1.6 [COMMAND] -> [Ref.1 channel] = **PLC card**
And after that you change the parameter in menu 1.14 [POSITIONING] -> [Command] to your choice of Command type for the positioning.

9.1 I/O TERMINAL AS COMMAND TYPE

Menu [1.14 POSITIONING] parameter [Command] = **[Terminal]**.

Following I/O configuration is active for Terminal command.





Input	Name	Function
LI51	Enable	0->1: Enable the drive
LI52	Halt	0->1: Brakes the motor with normal deceleration ramp 1->0: Interrupted movement is continued
LI53	Fault Reset	Clear an active alarm or a drive fault
LI54	Setpoint	0->1: Start Positioning command or Homing
LI55	Ref. Switch	Reference switch
LI56	Relative	Activate relative movement
LI57	Homing	Activate homing mode. Starts with Setpoint
LI58	LIMP	Hardware limit switch in positive direction
LI59	LIMN	Hardware limit switch in negative direction
LI60	QuickStop	1->0: Brakes the motor with deceleration ramp defined in parameter ”QStopRamp” Interrupted movement is loosed
LI1	Jog +	Start Jogging in positive direction
LI2	Jog -	Start Jogging in negative direction
LI3..LI6	Motion Task bit x	Activate a Motion Task number. Binary format Motion Task bit 0 = 1 Motion Task bit 1 = 2 Motion Task bit 2 = 4 Motion Task bit 3 = 8 Example: Motion Task 1 = bit 0 = **no.1** Motion Task 2 = bit 1 = **no.2** Motion Task 7 = bit 0 + bit 1 + bit 2 = **no.7** Motion Task 10 = bit 1+ bit 3 = **no.10**
AI1	AI1 Speed Adj.	Activate input AI1 to be a speed override adjustment. 0-100% of Target Speed
Output	**Name**	**Function**
LO51	Drive Fault	A drive fault is present. Drive is disabled (Find more info in chapter ”ALARM NUMBER”)
LO52	Target Reached	0: Target position not reached 1: Target position reached
LO53	Standstill	Motor at standstill. Motor speed <15rpm
LO54	HaltActive	A halt command is active.
LO55	Ref OK	Drive has valid reference point
LO56	QuickStopActive	QuickStop has activated. Clear with Fault Reset. Interrupted movement is loosed.

9.2 CANOPEN AS COMMAND TYPE

PDO3 should be activated and used in the PLC Configuration.
Menu [1.14 POSITIONING] parameter [Command] = **[CANopen]**.
The object inside PDO3 is fixed and can't be changed.

The object in PDO3 has the following meaning.

Transmit PDO3	**Receive PDO3**
Status word Positioning	Control word Positioning
Actual Position	Target Position
Actual Speed	Target Speed
Profile Position	Reserved

If you want to use the function "PLCRampAdj" or the mode 4 "Blending positioning mode" then you have to map the following object in to a free Receive PDO (PDO1 or PDO2).

Receive PDOx			
Obj. Idx.	Sub. Idx.	Parameter description	Function that comes active
2061	44	Com Scan Out6 val.	*Acceleration / **Target Position 2
2061	45	Com Scan Out7 val.	*Deceleration / **Target Speed 2

*Acceleration and Deceleration are used if parameter "PLCRampAdj" = Yes
**If "Blending positioning mode" is active then Target Position 2 and Target Speed 2 are used.

9.3 COM.CARD OR MODBUS AS COMMAND TYPE

Menu [1.14 POSITIONING] parameter [Command] = **[Com.card]** must be selected.
The I/O Scanner table in ATV71 is used for reference command.
For Ethernet card see chapter ”Ethernet Modbus TCP/IP as command type” for info.

Following table shows the automatic mapping.

Word	Modbus Address	I/O scanner input	Modbus Address	I/O Scanner output
1	12741	Status word CiA402 Not in use with positioning	12761	Control word CiA402 Not in use with positioning
2	12742	Output velocity CiA402 Not in use with positioning	12762	Speed Setpoint CiA402 Not in use with positioning
3	12743	Status word Positioning	12763	Control word Positioning
4	12744	Actual Position	12764	Target Position
5	12745	Actual Speed	12765	Target Speed
6	12746	Profile Position	12766	*Acceleration / **Target Position 2
7	12747	reserved	12767	*Deceleration / **Target Speed 2
8	12748	reserved	12768	reserved

*Acceleration and Deceleration are used if parameter ”PLCRampAdj” = Yes
**If ”Blending positioning mode” is active then Target Position 2 and Target Speed 2 are used.

9.4 ETHERNET TCP/IP AS COMMAND TYPE

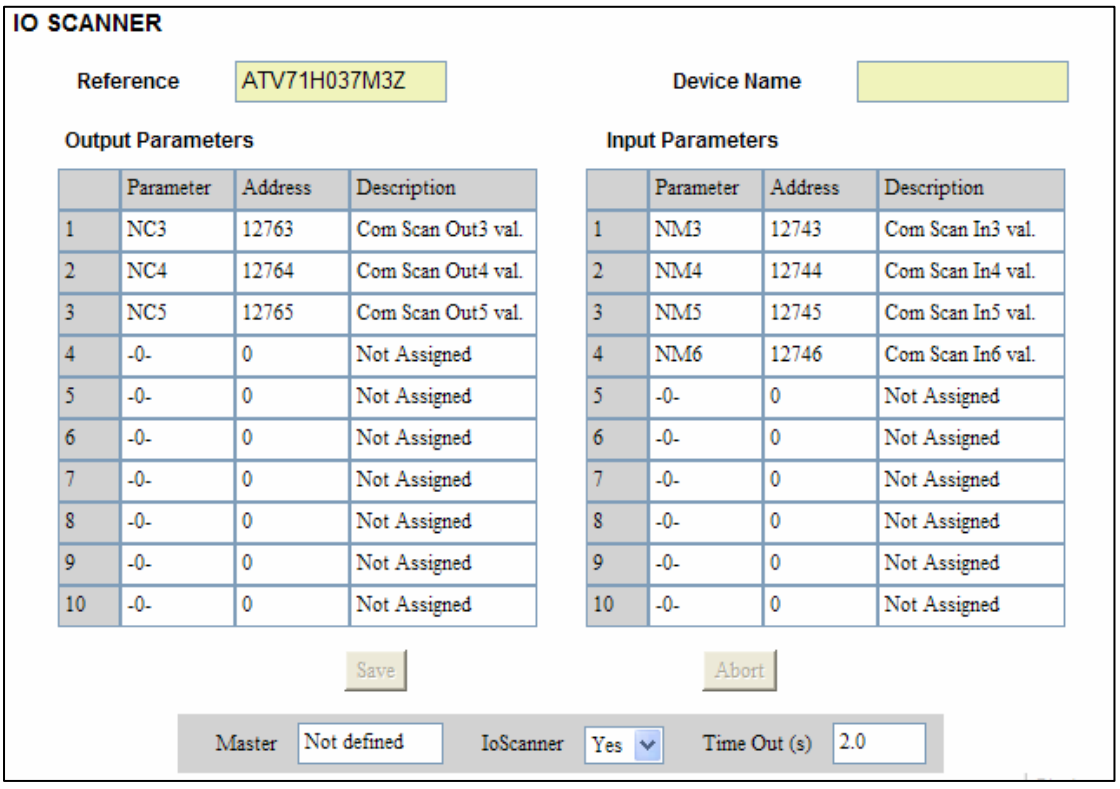
Menu [1.14 POSITIONING] parameter [Command] = **[Com.card]** must be selected.
The IO Scanner in the Ethernet card must be commissioned with the right objects.
This can be done with Powersuite or the web server.

The following objects should be written into the IO Scanner table.

Output Parameters			
Parameter	Address	Description	Function that becomes active
NC3	12763	Com Scan Out3 val.	Control Positioning
NC4	12764	Com Scan Out4 val.	Target Position (usr)
NC5	12765	Com Scan Out5 val.	Target Speed (rpm)
NC6	12766	Com Scan Out6 val.	*Acceleration / **Target Position 2
NC7	12767	Com Scan Out7 val.	*Deceleration / **Target Speed 2
Input Parameters			
Parameter	Address	Description	Function that becomes active
NM3	12743	Com Scan In3 val.	Status word Positioning
NM4	12744	Com Scan In4 val.	Actual Position
NM6	12745	Com Scan In5 val.	Actual Speed
NM6	12746	Com Scan In6 val.	Profile Position

*Acceleration and Deceleration are used if parameter ”PLCRampAdj” = Yes
**If ”Blending positioning mode” is active then Target Position 2 and Target Speed 2 are used.

Example with the web server:



	Parameter	Address	Description
1	NC3	12763	Com Scan Out3 val.
2	NC4	12764	Com Scan Out4 val.
3	NC5	12765	Com Scan Out5 val.
4	-0-	0	Not Assigned
5	-0-	0	Not Assigned
6	-0-	0	Not Assigned
7	-0-	0	Not Assigned
8	-0-	0	Not Assigned
9	-0-	0	Not Assigned
10	-0-	0	Not Assigned

	Parameter	Address	Description
1	NM3	12743	Com Scan In3 val.
2	NM4	12744	Com Scan In4 val.
3	NM5	12745	Com Scan In5 val.
4	NM6	12746	Com Scan In6 val.
5	-0-	0	Not Assigned
6	-0-	0	Not Assigned
7	-0-	0	Not Assigned
8	-0-	0	Not Assigned
9	-0-	0	Not Assigned
10	-0-	0	Not Assigned

9.5 COMMUNICATION BUS

Explanation for parameters that is for command from communication bus.

9.5.1 IN parameters to PLC

Statusword

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reference OK	Standstill	Target Reached	Fault Active	QuickStop Active	Halt Active	Setpoint Acknowledge	Operation Enabled
Bit 15	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
Error Number				Active Mode			

Bit	Description
0	**Operation Enabled** 1: Drive is enabled
1	**Setpoint acknowledge** 1: New target positioning accepted
2	**Halt active** 1: Halt command is active
3	**QuickStop active** 1: QuickStop command is active
4	**Fault active** 1: An active alarm or drive fault is present.
5	**Target reached** 1: Target position reached
6	**Standstill** 1: Motor at standstill. Motor speed<15rpm
7	**Reference OK** 1: Drive has valid reference point
8..11	**Active Mode** Extract this 4 bits to a decimal format to get the correct mode number 1 = Positioning mode 2 = Jogging mode 3 = Homing mode
12..15	**Error number** Extract this 4 bits to a decimal format to get the correct alarm number Read chapter ”ALARM NUMBER” for more info.

Actual Position

Range	-32768 ⇔ 32767
Unit	usr (see Position scaling for more info)
Function	Actual motor/axis position.

Actual Speed

Range	0 ⇔ 32767
Unit	Rpm
Function	Actual motor/axis speed.

Profile Position

Range	-32768 ⇔ 32767
Unit	usr (see Position scaling for more info)
Function	Actual motor position of the axis. Profil position is the theoretical position from the position generator that the motor should follow. Following error = Profil position – Actual position.

9.5.2 OUT parameters from PLC

Controlword

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Dimension Setting	Setpoint	Set Immediately	Relative	Fault Reset	QuickStop	Halt	Enable
Bit 15	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
Mode Selection				reserved	Jog Negative	Jog Positive	Reference switch

Bit	Description
0	**Enable** 1: Enable the drive
1	**Halt** 0->1: Brakes the motor with normal deceleration ramp 1->0: Interrupted movement is continued
2	**QuickStop** 0->1: Brakes the motor with deceleration ramp defined in parameter ”QStopRamp” Interrupted movement is loosed.
3	**Fault Reset** Clear an active alarm or a drive fault
4	**Relative** Activate relative movement
5	**Set Immediately** 0: only enable new position values when target position is reached 1: enable new position values immediately
6	**Setpoint** 0->1: Start Positioning command or Homing.
7	**Dimension setting** 1: Change temporary the Homing method to no.5
8	**Reference switch** Simulate reference switch. Only possible if RefSwitch with normal open contact is activated.
9	**Jog Positive** 1: Start jogging in positive direction
10	**Jog Negative** 1: Start jogging in negative direction
11	**Reserved**
12..15	**Mode Selection** Pack the 4 bits to a decimal format to set the correct mode number 1 = Positioning mode 2 = Jogging mode 3 = Homing mode

Target Position

Range	-32768 ⇔ 32767
Unit	usr (see Position scaling for more info)
Function	The destination position is different depending if absolute or relative positioning is used.

Target Speed

Range	0 ⇔ 32767
Unit	Rpm
Function	Max speed that the profile generator can use.

Target Position 2

Range	-32768 ⇔ 32767
Unit	usr (see Position scaling for more info)
Function	Only active if Mode Selection = 4, Blending Positioning Mode.

Target Speed 2

Range	0 ⇔ 32767
Unit	Rpm
Function	Only active if Mode Selection = 4, Blending Positioning Mode.

Acceleration

Range	100 ⇔ 30000
Unit	Rpm/s²
Function	”PLCRampAdj” = Yes Acceleration ramp of the profile generator.

Deceleration

Range	0 ⇔ 32767
Unit	Rpm/s²
Function	”PLCRampAdj” = Yes Deceleration ramp of the profile generator.

10 MODE SELECTION

It exists different mode selections depending of the operation to execute.
If the command is a communication bus the mode selection is done from the Controlword.
Or if the command is I/O Terminal the mode selection is done with logical inputs.

10.1 POSITIONING (MODE 1)

10.1.1 I/O Terminal

With I/O Terminal as the command channel the positioning mode is automatically chosen if no other modes is active like the homing or jogging mode.

The target position to reached is chosen with the logical inputs LI3 – LI6 in binary format. Configuring positions 1 – 15 is done in menu [1.14 POSITIONING] parameter [SetMotionTask]. See chapter Parameters for the explanation of MotionTask parameters.

Example:
To start a positioning to MotionTask 2 we set input LI4 = 1.
Then we set input LI55 - Setpoint = 1. The confirmation that the positioning is started is when output LO52 – Target Reached goes low. When the positioning is finished the output LO52 – Target Reached goes high again.

10.1.2 Communication bus

With command channel set to a supported communication bus the Controlword bit 12 – 15 is used to change the mode to positioning.

Example:
Set Mode Selection = 1 (Bit 12) in Controlword.
Go to absolute value 2000usr with a speed of 1500rpm.
Parameter Target Position = 2000 and Target Speed = 1500
Set Setpoint (bit 6) = 1 in Controlword. Wait to get back SetpointACK (bit 1) = 1 from Statusword. Then you now that your values are correct and accepted. Also Target Reached goes low when the positioning start and you now that the positioning is done when Target Reached goes high again.

10.2 JOGGING (MODE 2)

10.2.1 I/O Terminal

With I/O Terminal as the command channel the jogging mode is automatically chosen if no other mode is in progress and you set either input LI1 Jog Positive or LI2 Jog Negative.

10.2.2 Communication bus

With command channel set to a supported communication bus the Controlword bit 12 – 15 is used to change the mode to jogging.

Example:
Set Mode Selection = 2 (Bit 13) in Controlword.
To jog in positive direction you set and hold bit 9 in Controlword.
And to jog in negative direction you set and hold bit 10 in Controlword.
The jogging movement is stopped as soon as you set the bits to low state.

10.3 HOMING MODE (MODE 3)

In homing mode, an absolute scale reference of the motor position at a defined axis position is established. Referencing can be carried out by a homing movement or by dimension setting.

10.3.1 I/O Terminal

With I/O Terminal as the command channel the homing mode is activated with input LI57 – Homing. First you should have to set the right homing procedureyou're your machine with parameter [HMmethod] in menu [1.14 POSITIONING].
Then you start the homing sequence with input LI55 – Setpoint.

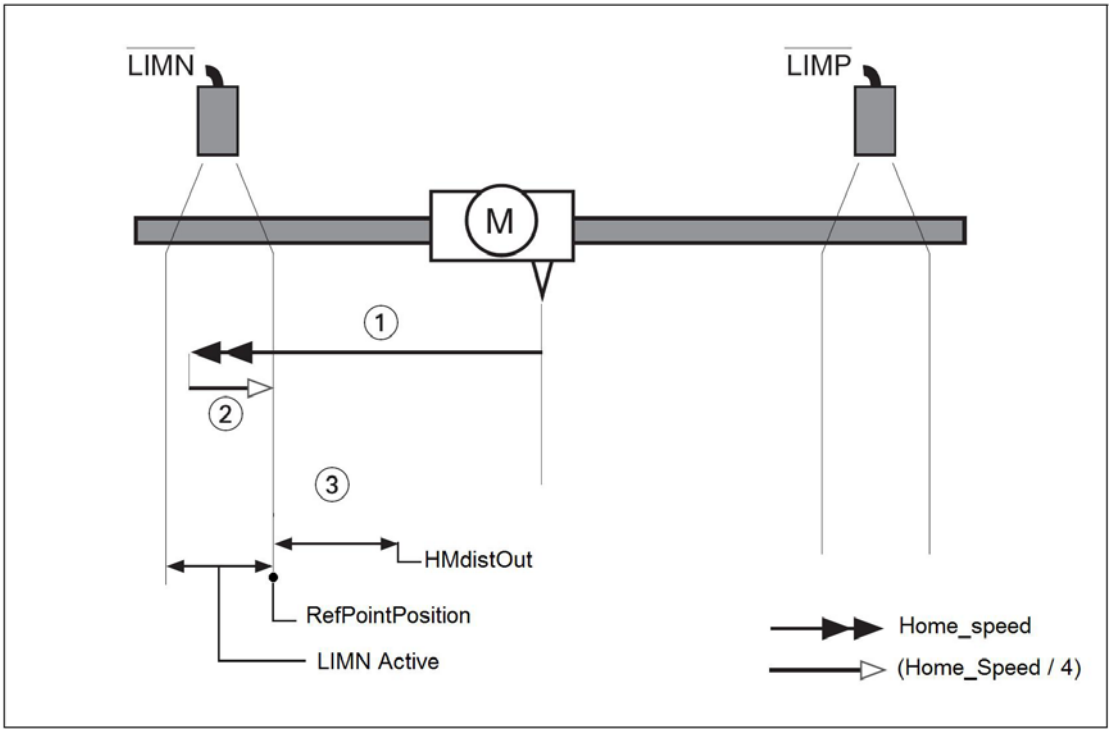
10.3.2 Communication bus

With command channel set to a supported communication bus the Controlword bit 12 – 15 is used to change the mode to homing.

Example:
Set Mode Selection = 3 (bit 12 and Bit 13) in Controlword.
Start the homing sequence with Setpoint (bit 6) = 1 in Controlword.
The homing sequence is done when Reference OK (bit 7) goes high.

10.3.3 Homing Method 1

With method 1 the homing is carried out with movement to negative hardware limit switch.



1. Start of homing to LIMN with the speed of parameter Home_Speed.

2. The axis hits the LIMN and starts to extract in positive direction with ¼ of Home_Speed.
   On falling edge of the switch the parameter RefPointPosition is written to Actual Position and the reference is OK.

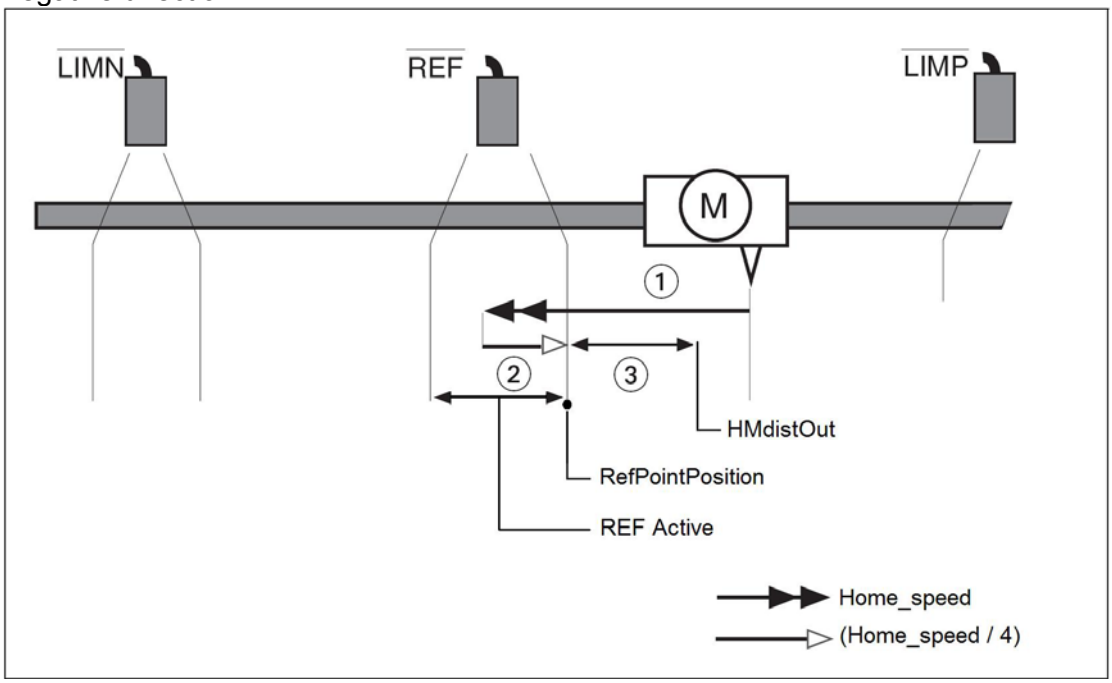
3. The motor stops when the parameter HMdistOut is fulfilled. This distance is to make sure the axis stop it not to near the LIMN switch.

10.3.4 Homing Method 2

Method 2 is similar to the method 1 with the different of a start to move to the positive hardware limit switch.

10.3.5 Homing Method 3

With method 3 the homing is carried out with movement to a reference switch in negative direction.



1. Start of homing to REF with the speed of parameter Home_Speed.

2. The axis hits the REF and starts to extract in positive direction with ¼ of Home_Speed.
   On falling edge of the switch the parameter RefPointPosition is written to Actual Position and the reference is OK.

3. The motor stops when the parameter HMdistOut is fulfilled.

Remark: If the machine is equipped with hardware limit switches and the axis is on the wrong side of the reference switch. The axis turns around when it hits the LIMx switch and continues to search the REF switch.

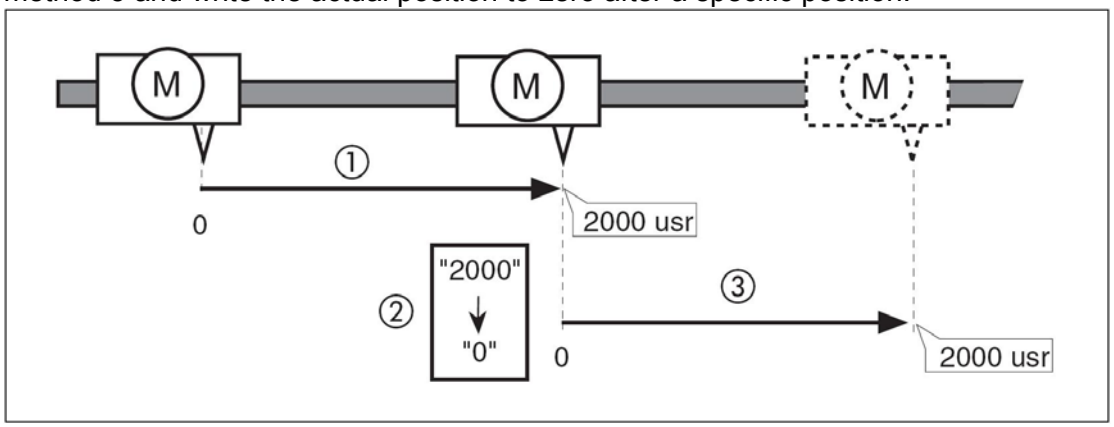
10.3.6 Homing Method 4

Method 4 is similar to the method 3 with the different of a start to move to the positive direction.

10.3.7 Homing Method 5

With method 5 the user can make a homing without movements. A so called “Dimension setting”. Any active position deviation is also retained.
The reference position is adjustable in fieldbus command because the value in ”Target Position” is written as new position. And with fieldbus command it’s possible to shift to method 5 with bit 7 in control word so you can have another method as default type.
In Terminal command the parameter RefPointPosition is written as new position.

Example:
It can be used to make an endless movement in one direction.
To not overrun the internal max position of 2147483647 Inc we make a homing with method 5 and write the actual position to zero after a specific position.



1. An absolute movement of 2000 usr is carried out.

2. When the axis has reached its final destination we send a homing command and the actual position gets the new value.

3. Then we start a new absolute movement of 2000 usr.

With this cycle we can carry out a position in an endless loop without get a position overrun.

10.4 BLENDING POSITIONING (MODE 4)

Blending Positioning is not working with I/O Terminal as command channel.
It's only active with communication bus as command channel.
Set Mode Selection = 4 in Controlword to activate Blending Positioning mode.

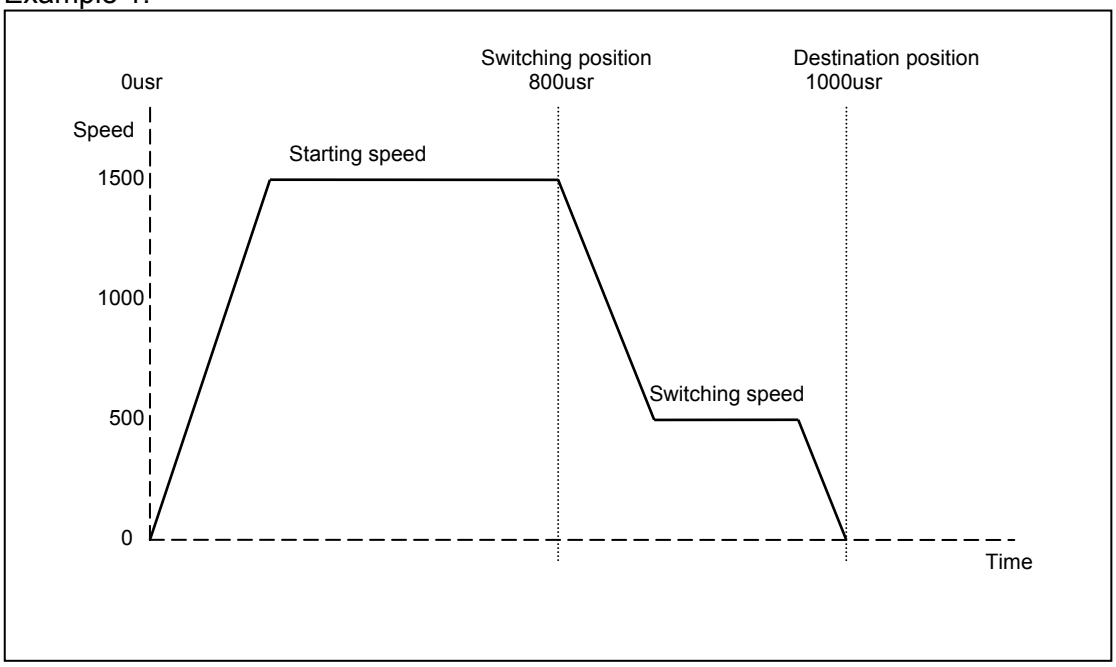
With Blending Positioning mode it's possible to trigger one positioning sequence that have an automatically speed change on a predefined position point.
You have to set one speed to define the starting speed. And one speed as the switching speed. Along with the speed you also define a destination position and a switching position.

Some standard OUT parameters from the PLC get new functions

Standard function	New funktion
Controlword Positioning	none
Target Position	Destination position
Target Speed	Starting speed
*Target Position 2	Switching position
*Target Speed 2	Switching speed

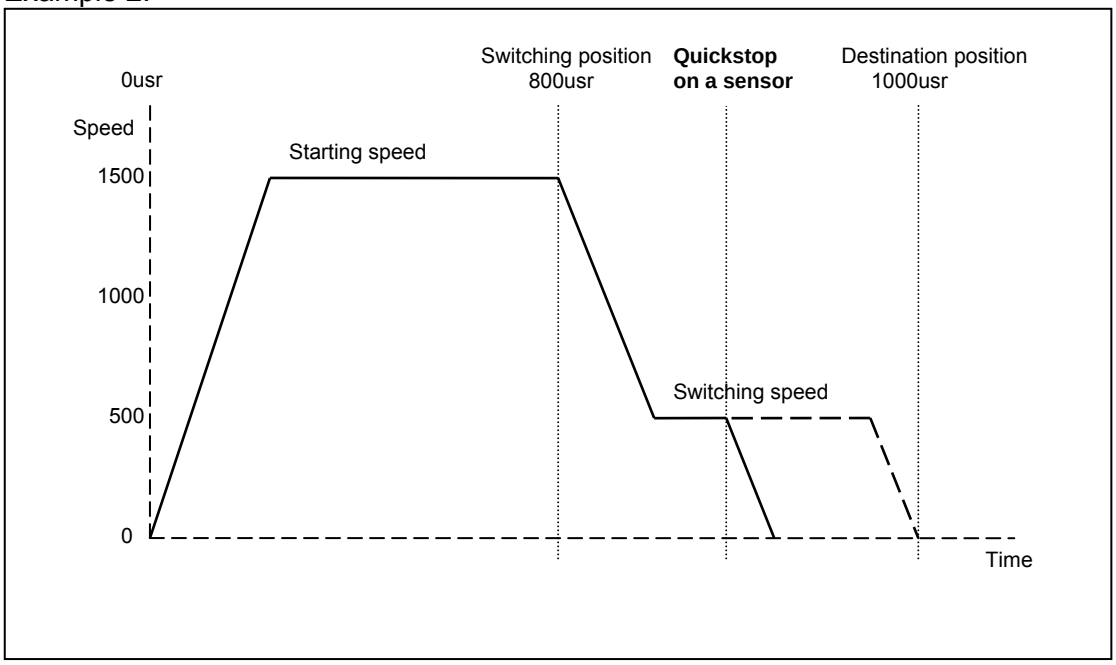
*parameters that changes with blending positioning mode.

Example 1:



Start with a absolute destination position to 1000usr with a starting speed of 1500rpm.
Switching position set to 800usr and switching speed to 500rpm.

Example 2:



With this example we will stopp on a sensor before we reach the destination position. The destination position is now a safety position. If we reach this point the sensor is mailfunction.

1. Start with an absolute destination position to 1000usr with a starting speed of 1500rpm.
   Switching position is set to 800usr with a switching speed of 500rpm.

2. Quickstop command is triggered from a sensor an activated with bit 2 in Controlword skickas efter att en givare har påverkats.
   The destination position after quickstop is around 900usr.

11 FIRST STARTUP

Here is a quick help with points that can help you with the first startup.
The quick help assume that all parameters is adjusted with the Graphic Terminal and that no parameters have been adjusted since factory setting.

1. Adjust all parameters for motor data in menu [1.1 SIMPLY START].

2. Make an auto tuning in menu [1.1 SIMPLY START]

3. Adjust parameters in menu [1.4 MOTOR CONTROL] for the encoder.
   Parameter EnS – [Encoder type] and PGI – [Number of pulses].

4. Change in menu [1.6 COMMAND], Parameter Fr1 – [Ref.1 channel] = [HMI].

5. Adjust in menu [1.3 SETTINGS] parameters [Acceleration] and [Deceleration] to values that is suitable for manual movement of the machine.

6. Make a test run from the Graphical Terminal and see that the machine moves in positive direction with a positive speed reference.
   If not, change the phase rotation for the motor. This can easily be done with parameter PHr – [Output Ph rotation] in menu [1.4 MOTOR CONTROL].

7. Go to menu [1.4 MOTOR CONTROL] and activate [Encoder check] = Yes.
   Make a manual movement with at least 10Hz and at the same time check the status of parameter [Encoder check]. If the parameter change to “Done” the encoder rotation is correct. But if the drive trips in “Encoder fault” the rotation of the pulses is incorrect. Change place with cable marked A and Ā on the encoder board and make the encoder check procedure again.

8. Adjust the following parameters in menu [1.4 MOTORSTYRNING]:
   Encoder mounted on the motor shaft: Ctt – [Motor control type] = [FVC]
   Encoder mounted after the gearbox: Ctt – [Motor control type] = [SVC I]

9. Now make some more test run manually from the Graphic Terminal and see if the axis moves without any strange vibrations and currents.
   If the axis have tendency to vibrate adjust the parameter SPG – [Speed prop. gain] in menu [1.3 SETTINGS]. Decrease the value in steps until the vibrations disappear.

10. Adjust in menu [1.6 COMMAND], Parameter [Ref.1 channel] = [PLC card]

11. Adjust in menu [1.14 POSITIONING], all parameters that is relevant for the machine. See chapter “PARAMETERS”.

12. Now the drive is ready to be tested from the command source that you have chosen in menu [1.14 POSITIONING] – Parameter [Command].

12 ALARM NUMMER

When a alarm is triggered from positioning application or the drive itself the alarm is showing up on the graphic terminal with a describing help text (F1 button).

All alarm makes the drive go into freewheel stop.

Alarm number	Description
1. Following error	On first commissioning the limit P_maxDiff should be adjusted so that the value is minimum 20% above the actual p_Dif on maximum speed. For most reason when this alarm gets active it's that the motor don't have the torque to follow the profile generator.
2. Negative software limit	A target position is command outside the negative software limit.
3. Positive software limit	A target position is command outside the positive software limit.
4. Positive hardware limit	Positive hardware limit switch have been activated
5. Negative hardware limit	Negative hardware limit switch have been activated
6. Homing is not performed	Homing procedure have not been done correctly yet.
14. External Encoder fault	Fault on the external encoder signals. The pulses coming from external encoder are not in the expected interval. Check encoder wiring and coupling. If the alarm sets on first commissioning then it's probably wrong scale factor for external encoder function.
15. Drive fault	Drive fault activated. See the graphic display for more description. Or read out the parameter Altivar fault code: Logical address: 7121 CANopen index: 2029/16